

# *Elena Rufeil Fiori*

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## **PERSONAL INFORMATION**

Date of birth: Aug. 15<sup>th</sup>, 1980.

Place of birth: Córdoba, Argentina.

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## **CONTACT INFORMATION**

Facultad de Matemática, Astronomía y Física (FaMAF),

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## **EDUCATION**

### **Ph. D. in Physics,**

Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, Argentina.  
2004-2009.

Thesis: “Coherent dynamics of charge and spin excitations in one-dimensional systems”.

Advisor: Dr. Horacio M. Pastawski.

### **M. Sc. in Physics (Bachelor included),**

Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, Argentina,  
1999 - 2004.

Thesis: “Fermi golden rule and dynamical interference effects in model systems”.

Advisor: Dr. Horacio M. Pastawski.

GPA: 9,67/10.

## **REFEREED JOURNAL PUBLICATIONS**

- “*A Shannon-Tsallis transformation*”, E. Rufeil Fiori, A. Plastino. *Physica A* 392 1742–1749 (2013)  
arXiv:1201.4507
- “*Effective one-body dynamics in multiple-quantum NMR experiments*”, E. Rufeil Fiori, C. M. Sánchez, F. Y. Oliva, H. M. Pastawski, P. R. Levstein, *Phys. Rev. A* 79, 032324 (2009). *Virtual Journal of Nanoscale Science & Technology* 19, Issue 16, April 2009. *Virtual Journal of Quantum Information* 9, Issue 4, April 2009. arXiv: 0810.1722.
- “*Survival Probability of a local excitation in a Non-Markovian environment: Survival Collapse, Zeno and Anti-Zeno effects*”, E. Rufeil Fiori, H. M. Pastawski, *Physica B* 404, 2812-2815 (2009). arXiv: 0812.1009.
- “*Survival probability of surface excitation in a 2d lattice: non-Markovian effects and Survival Collapse*”, E. Rufeil Fiori, H. M. Pastawski, *Braz. Journ. of Phys.* 36, 844-847 (2006). arXiv:quant-ph/0604069.
- “*Non-Markovian decay beyond the Fermi Golden Rule: Survival Collapse of the polarization in spin chains*”, E. Rufeil Fiori, H. M. Pastawski, *Chem. Phys. Lett.* 420, 35-41 (2006). arXiv: quant-ph/0511176.

## **SUBMITTED JOURNAL PUBLICATIONS**

- “*Markovian models for one dimensional structure estimation on heavily noisy imagery*”, A. G. Flesia, J. Gimenez, E. Rufeil Fiori, sent to publish. arXiv: 1304.7713.

## **RESEARCH EXPERIENCE**

### **Colloids simulations**

Studies of colloidal bidimensional systems using Brownian dynamics simulations and Green-Kubo relations. Structural and dynamical quantities were obtained under different interactions between particles and different area fraction occupied.

### **Lipid monolayers**

Experimental studies of rheology of lipid monolayers with phase coexistence using Langmuir balance, optical microscopy and fluorescence microscopy. Different interaction between domains of the condensed phase were studied as well as the diffusion of tracers (latex beads) on the monolayer in presence of these domains.

### **Image processing techniques**

Simulation and classification of optical images. Comparison and quality quantification of different edge detectors; the widely known Canny and Sobel, and the wavelet based detectors Threshold Haar and Hidden Markov Model edge detectors.

### **Quantum Physics**

Analytical and numerical studies on coherent dynamics of charge and spin excitations in one-dimensional systems. Studies of the effect of Markovian and Non-Markovian environments, mapping from many-body to one-body dynamics, injection condition in the Schrödinger equation, temporal reversion, and Loschmidt echo.

## **Nuclear Magnetic Resonance Experiments**

Development of a experiment leading to one-body dynamics using spin chains in crystal powders at room temperature. Multiple quantum coherences dynamics. Studies of decoherence through Loschmidt echoe and design of quantum channels.

## **AWARDS AND FELLOWSHIPS**

**Postdoctoral fellowship of CONICET** (National Council of Science and Technology, Argentina): April 2013 to April 2015.

**Financial Support program for assistance to courses**, Latin American Network of Biological Sciences. Financial support for the Assistance to the course "Principles of Single Molecule Biophysics and its Applications" taught by Prof. Dr. Carlos Bustamante (University of California, Berkeley). 21 to 25 March 2011.

**Doctoral fellowship of CONICET** (National Council of Science and Technology, Argentina): April 2004 to April 2009.

**Internship, National University of Singapore**, Singapore. Advisor: Vlatko Vedral. Feb-Mar 2009.

**Internship, Universidade do Estado do Rio de Janeiro**, Brasil. Advisor: C. H. Lewenkopf. Feb-Mar 2006.

**Young Collaborator Program fellowship**, ICTP, Trieste, Italy, Aug-Oct 2004.

**University Prize**, Universidad de Córdoba, Honor mention to the best GPA 2004.

## **TEACHING EXPERIENCE**

### **Teacher Assistant**

Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba.

- 2003. 1st. Semester: Laboratory course of General Physics II; introduction to thermodynamics. 2nd. Semester: Mathematical Methods of Physics (Problems).
- 2004. 1st. Semester: Introduction to Condense Matter Physics (Problems).

### **Assistant Professor**

Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba.

- 2005. 1st. Semester: Introduction to Newtonian Physics (Problems). 2nd. Semester: Introduction to Quantum Physics (Problems).
- 2006. 1st. Semester: Introduction to Newtonian Physics (Problems).
- 2007. 1st. Semester: Introduction to Newtonian Physics (Problems). 2nd. Semester: General Physics I (Problems); Newtonian physics.
- 2008. 1st. Semester: General Physics IV (Problems); Classical optics.
- 2009. 1st. Semester: Laboratory course of General Physics IV; Classical optics. 2nd. Semester: Laboratory course of General Physics I; Newtonian Mechanics.
- 2010. Summer course: Preparatory Course for physics, mathematics, astronomy and computation sciences degree programs. 1st. Semester: Laboratory course of General Physics IV; Classical optics. Winter course: Informatics course for high school students. Winter course: Informatics course for

retired persons. 2nd. Semester: General Physics II for chemistry degree program; classical optics, electrostatic and principles of electrical engineering.

- 2011. 1st Semester: Thermodynamics (Problems). 2nd Semester: Calculus II for computation science degree program (Problems).
- 2012. 1st Semester: Thermodynamics (Problems). 2nd Semester: Statistical Mechanics (Problems).
- 2013. 1st Semester: Thermodynamics (Problems). 2nd Semester: Statistical Mechanics (Problems).
- 2014. 1st Semester: Introduction to Newtonian Physics (Problems). 2nd. Semester: General Physics I (Problems); Newtonian physics.

### VISITING POSITIONS

- National University of Singapore, Singapore. Advisor: Vlatko Vedral. Feb-Mar 2009.
- Universidade do Estado do Rio de Janeiro, Brazil. Advisor: C. H. Lewenkopf. Feb-Mar 2006.
- International Center of theoretical Physics (ICTP), Trieste, Italy, Aug-Oct 2004.

### SEMINARS AND INVITED TALKS

- “*Study of the structure and dynamics of domains in lipid monolayers with phase coexistence*” talk given at “XIV Encuentro de Superficies y Materiales Nanoestructurados”, Bariloche, Argentine, May 2014.
- “*Effective one-body dynamics in multiple-quantum Nuclear Magnetic Resonance experiments*” Research Seminar, Biochemisches Institut, Universität Zürich (UZH), Nov 2012. Moderator: Benjamin Schuler.
- “Dinámica coherente de excitaciones de carga y espín en sistemas unidimensionales”. *Graduated Thesis. FaMAF-UNC, Córdoba, Nov 2009. Moderator: Horacio Pastawski.*
- “Effective one-body dynamics in spin chains; coherence, interference and decoherence”. *Talk given at -NUS, Singapore, Feb 2009. Moderator: Vlatko Vedral.*
- “Qué son las coherencias cuánticas múltiples en NMR?” *Seminar given at FaMAF-UNC, Córdoba, Nov 2009. Moderator: Horacio Pastawski.*
- “Punto cuántico como bit cuántico” *Seminar given at FaMAF-UNC, Córdoba, October 2009. Moderator: Horacio Pastawski.*
- “Survival probability of a local excitation in a non-Markovian environment: Return effects and Survival collapse” *Talk given at Universidade do Estado do Rio de Janeiro, Brazil, Feb 2006. Moderator: Caio H. Lewenkopf.*

### PARTICIPATION IN CONFERENCES

- “XIV Encuentro de Superficies y Materiales Nanoestructurados”, CAB, Bariloche, Argentine, 15-16 May 2014.
- “XLII Annual meeting argentinian biophysical society SAB 2013”, Carlos Paz, Córdoba, Argentine, 2-4 Dec. 2013.

- “*XIII Latin American Workshop on Nonlinear Phenomena LAWNP 2013*”, Carlos Paz, Córdoba, Argentine, 21-25 Oct. 2013.
- “*XV Giambiagi winter school. Information processing in biological systems: from cells to equations, and back*”, Buenos Aires, Argentine, 15 - 19 Jul. 2013, “Effective one-body dynamics in multiple-quantum Nuclear Magnetic Resonance experiments”, E. Rufeil Fiori, C. M. Sanchez, F. Y. Oliva, H. M. Pastawski and P. R. Levstein.
- “*Winter school on quantitative systems biology*” Trieste, Italy, 26 Nov. - 07 Dec. 2012.
- “*IV Congreso Latinoamericano de Matemáticos CLAM 2012*”, Córdoba, Argentine, 6 - 10 Aug. 2012, “Quality control of edge maps: a measure of comparison between automatic image edge labeling methods”, J. Gimenez, E. Rufeil Fiori, A. G. Flesia, “A comparison between two edge maps based on the Non-decimated Haar Wavelet: standard thresholding versus 1d Hidden Markov Model”, E. Rufeil Fiori, J. Gimenez, A. G. Flesia.
- “*10° Regional Congress of Statistical Physics and Condense Matter Applications*”, La Falda, Cordoba, Argentine, 20-24 May 2012.
- “*Fluctuations and nonequilibrium systems*”, Santiago de Chile, Chile, 05-10 Dec. 2012. “Effective one-body dynamics in multiple-quantum Nuclear Magnetic Resonance experiments”, E. Rufeil Fiori, C. M. Sanchez, F. Y. Oliva, H. M. Pastawski and P. R. Levstein.
- “*Principles of single molecule biophysics and its applications*”, Santiago de Chile, Chile, 21-25 Mar. 2011.
- “*4º Argentinian school of Mathematics and Biology; BIOMAT 2010*”, La Falda, Córdoba, Argentine, 02-05 Aug. 2010.
- “*At the frontiers of condensed matter IV*”, Buenos Aires, Argentine, 9 - 12 Dec. 2008, “Survival Probability of a local excitation in a Non-Markovian environment: Survival Collapse, Zeno and Anti-Zeno effects”, E. Rufeil Fiori and H. M. Pastawski.
- “*Quantum Optics IV*”, Florianopolis, Brazil, 13 - 17 Oct. 2008, “Multiple Quantum Coherence and Decoherence in a Restricted Hilbert Space”, E. Rufeil Fiori, C. M. Sanchez, F. Y. Oliva, H. M. Pastawski and P. R. Levstein.
- “*Mini-School on Disordered Systems 2008 and 6th International Workshop on Disordered System*”, La Falda, Córdoba, Argentine, 8 - 12 Sep. 2008, “Multiple Quantum Coherence and Decoherence in a Restricted Hilbert Space”, E. Rufeil Fiori, F. Y. Oliva, C. M. Sanchez, H. M. Pastawski and P. R. Levstein.
- “*Applied Optics Meeting*”, Buenos Aires, Argentine, 29 - 30 Oct. 2007, “Multiple quantum coherence as detector of one-body one-dimensional dynamics in NMR experiments”, E. Rufeil Fiori, F. Oliva, P. R. Levstein, K. Chattah, H. M. Pastawski.
- “*Quantum information School and Workshop Paraty 2007*”, Paraty, Rio de Janeiro, Brazil, 6 - 16 Aug. 2007, “Multiple quantum coherence as detector of one-body one-dimensional dynamics in NMR experiments”, E. Rufeil Fiori, F. Oliva, P. R. Levstein, H. M. Pastawski.

- “*Conference on Quantum Phenomena in Confined Dimensions*”, Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, 4 - 8 Jun. 2007, “One dimensional many-body dynamics in spin chains detected through multiple quantum coherence NMR experiments”, E. Rufeil Fiori, F. Oliva, P. R. Levstein, H. M. Pastawski.
- “*Magnetic Resonance in a Cordubensis Perspective*” (with R. R. Ernst), Córdoba, Argentine, 30 Nov. - 1 Dec. 2006, “Survival Probability and Multiple Quantum Coherence in 1d spin chain”, E. Rufeil Fiori, F. Oliva, P. R. Levstein, H. M. Pastawski.
- “*College on Physics of Nano-Devices*”, Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, July 2006, “Survival probability of a local excitation in a non-Markovian environment: Return effects and Survival collapse”, E. Rufeil Fiori, H. M. Pastawski.
- “*12<sup>o</sup> Latin American Congress of Surface Science and its applications*”, Angra dos Reis, Rio de Janeiro, Brazil, Dec. 2005, “Survival probability of surface excitation in a 2d lattice: non-Markovian effects and Survival Collapse”, E. Rufeil Fiori, H. M. Pastawski.
- “*Quantum symposium. Time of Challenges: Harnessing the Uncertainties of the Quantum World*”, Córdoba, Argentine, Oct. 2005. “Survival Probability and Survival Collapse in a linear spin chain”, E. Rufeil Fiori, H.M. Pastawski.

### **POSTGRADUATE COURSES**

- “*VI POSLATAM Course*”, lecturers: Dr. L. Bagatolli (Department of Biochemistry and Molecular Biology, University of Southern Denmark, Denmark), Dr. B. Sorre (Center for Studies in Physics and Biology, The Rockefeller University, New York), Dr. A. Disalvo (Universidad Nacional de Santiago del Estero), Dr. N. Wilke, Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, Córdoba, Argentine, 22 hours.
- “*Biological photoreceptors*”, lecturer: Dr. S. E. Braslavsky (Max-Planck-Institute for Bioinorganic Chemistry, Mülheim an der Ruhr, Germany), Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, Córdoba, Argentine, 32 hours.
- “*Notions of general chemistry*”, lecturers: Dr. Marisa Martinelli, Dr. Martín Sandra, Dr. Viviana Nicotra, Dr. Manuel Velasco, Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, Córdoba, Argentine, 40 hours.
- “*Structure and dynamics of proteins*”, lecturers: Dr. G. Montich, Dr. M. B. Decca, Dr. M. E. Carrizo, Dr. S. Celej. Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, Córdoba, Argentine, 24 hours.
- “*Mechanical properties of interfaces and macromolecules by using optical tweezers*”, lecturers: Dr. D. Guerra Giraldez (Universidad Peruana Cayetano Heredia, Lima, Peru), Dr. T. M. Fischer (University of Bayreuth, Germany), Dr. Natalia Wilke, Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, Córdoba, Argentine, 10/10, 29 hours.
- “*History of Physics*”, lecturer: Dr. W. Lamberti, Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, Córdoba, Argentine, 60 hours.

- **"Mathematical Biology"**, lecturers: Dr. C. Condat, Dr. G. Sibona, Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, Córdoba, Argentine, 60 hours.
- **"Nonequilibrium fluctuations in small systems: from physics to biology"**, lecturer: Prof. Dr. Félix Ritort (Universitat de Barcelona, Spain), Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, Santiago, Chile, 14 hours.
- **"4 out of equilibrium lectures"**, lecturer: Prof. Dr. Jorge Kurchan (ESPCI, France), Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, Santiago, Chile, 14 hours.
- **"Principles of single molecule biophysics and its applications"**, lecturer: Prof. Dr. Carlos Bustamante (University of California, Berkeley). Facultad de Ciencias Químicas y Farmacéuticas, Universidad de Chile. 14 hours.
- **"Segmentation using hidden Markov models"**, lecturer: Dr. Georgina Flesia. Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, 10/10, 60 hours.
- **"Cellular and Molecular Neurobiology"**, coordinator: Dr. Roberto A. Rovasio, lecturers: Dr. Roberto A. Rovasio, Dr. Santiago Quiroga, Dr. Dolores Carrer, Dr. Eduardo Garbarino, Dr. Hugo Maccioni, Dr. Alfredo O. Cáceres, Dr. Pablo Iribarren, Dr. Daniel Mascó, Dr. Hugo Carrer, Dr. Héctor López, Dr. Gabriela Paglini. Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba. 10/10. 40 hours.
- **"Stochastic Processes"**, lecturer: Dr. Carlos Budde, Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, 60 hours.
- **"Multiple Quantum Coherence and advance techniques in Nuclear Magnetic Resonance"**, lecturer: Dr. P. R. Levstein, Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, 60 hours.
- **"Introduction to critical phenomena"**, lecturer: Dr. P. Serra, Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, 10/10, 60 hours.
- **"Quantum Computation"**, lecturer: Dr. H. M. Pastawski, Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, 10/10, 60 hours.
- **"Average Hamiltonians and Floquet Theory in Nuclear Magnetic Resonance: Theory and Applications"**, lecturer: Prof. P. R. Levstein and H. M. Pastawski, Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, 10/10, 60 hours.
- **"Molecular Electronic"**, lecturer: Prof. H. M. Pastawski, Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, 10/10, 60 hours.
- **"Chaos and Non-linear Dynamics"** Prod.: Universidad Politécnica de Madrid, Prof. Inv.: H. M. Pastawski, Universidad Nacional de Córdoba, 10 hours.

### **TEACHER TRAINING COURSES**

- **"Teacher Training Workshop"**, lecturers: Prof. Mónica Villarreal, Prof. Cristina Esteley, Prof. Zulma Gangoso, Facultad de Matemática, Astronomía y Física, Universidad Nacional de Córdoba, 9 hours.

## LANGUAGE SKILLS

- *Spanish*, mother tongue.
- *English*, fluent.
- *Portuguese*, reading and spoken.

## COMMUNITY SERVICE AND OTHER EXPERIENCE

- “*Informatics course for high school students*”, programme "Jóvenes con más y mejor trabajo", Secretaría de extensión universitaria, Universidad Nacional de Córdoba, July 2010.
- “*Informatics course for retired persons*”, programme "UPAMI", Secretaría de extensión universitaria, Universidad Nacional de Córdoba, Aug 2010.